

Commissioner for Patents

Serial No. 10/770,474

REMARKS

Claims 1 to 25 and 34 are in the case.

Non-elected claims 26 to 33 were cancelled previously.

Election/Restrictions

It is recognized that claims 2 to 5, 12, and 13 are withdrawn from consideration as being drawn to non-elected species.

It is indicated that claims 10 and 11 are now withdrawn from further consideration as being directed to a non-elected species.

As indicated previously, the problem is with the original election requirement. Applicant was given the option of electing species in which  $Y_1$  and  $Y_2$  were both present or species in which  $Y_1$  and  $Y_2$  were both absent. This, however, does not cover all the possibilities. Clearly, there are species in which  $Y_1$  is present and  $Y_2$  is absent, and furthermore, there are species in which  $Y_1$  is absent and  $Y_2$  is present. Applicant was not asked to make an election with respect to these species.

Indeed, compounds of particular interest are the phosphonium compounds of claims 13 and 14. In these compounds,  $Y_1$  is present but  $Y_2$  is absent (because  $t$  is 0). Reconsideration of the status of claims 10 and 11 is requested.

Claim Objections

Claim 24 has been amended to delete the particular compound DTPA, and this overcomes the objection.

Claim Rejections – 35 U.S.C. 112

Concerning the objection to claims 1, 6, 7, 18, 19, and 24, the claims have been amended to remove the exemplification "such as". In some cases, such as in claims 1, 6, and 7, the claim now specifically recites what previously was only an exemplification. Thus, in claims 1, 6, and 7, boron trifluoride is included in the definition of  $Y_2$ .

Claims 21 to 23 and 25 have been amended to replace the references to "the treatment" and "said treating" by reference to bleaching and stabilizing in agreement with claim 1. It is believed that this meets the objection.

Claim 1 has been amended to replace the expression "the molecule" by "said compound of formula (A)", thereby overcoming the antecedent problem. This is consistent with the Examiner's understanding of what was intended.

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Claim 23 has been amended to refer to the lignocellulosic material rather than "the pulp".

Concerning the limitations from the seventh to fifteenth lines of claim 1, these have been preceded by "when  $t = 1$ ,". This links the definition with the immediately preceding definitions. Thus, it is first indicated that  $t$  is 0 or 1; then definitions are then set forth when  $t$  is 0, and thereafter when  $t$  is 1. It is believed that this meets the objection.

Concerning the second objection to claim 1, when  $y$  is 1 and  $n$ ,  $z$ , and  $m$  are all 0,  $Y_1$  can be present or absent. When it is absent, the compound (A) will be a simple phosphine. The compound of claim 15 is a compound illustrative of the case where  $Y_1$  is present. In this case,  $Y_1$  is a carboxylate moiety as set forth and specifically a propionate. In this case, the "propionate" is not a counter ion; rather, the alkylene portion of the propionate is covalently bound to P resulting in a phosphonium ion which is balanced by the carboxyl portion of the propionate. This is in the nature of an internal phosphonium compound where the negative charge appears on one of the four radicals covalently bound to the phosphorus. This is nevertheless within the scope of formula (A). It can be seen that there is no charge imbalance in the compound of claim 15.

It is correct that if  $t = 0$ , then  $Y_2$  is not present since the whole of the radical  $R_4R_5PY_2$  will be absent when  $t = 0$ .

As indicated above and as indicated previously, applicant made its elections from the options presented to it in the Office Action of November 1, 2005. Those requests for election were silent with respect to some embodiments of the invention. More especially, it is evident from formula (A) and as apparently now recognized by the Examiner, that if  $t$  is 0, then  $Y_2$  will be absent but this does not affect  $Y_1$  which may be present or absent.

While applicant elected the species in which  $Y_1$  and  $Y_2$  are both present based on the two options provided, it did so on the understanding that when  $t$  is 0 (also elected),  $Y_2$  would necessarily be absent since the P radical with which it is associated is absent when  $t$  is 0.

Concerning the finding that claim 15 is indefinite, claim 1 has been edited to overcome the problem.

Indeed, the following amendments have been made to claim 1.

First, the essential values of  $m$ ,  $y$ ,  $n$ , and  $z$  and their relationship have been set forth prior to former lines 16 and 17 of claim 1.

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The definition at former lines 16 and 17 of claim 1 has been edited to indicate that when y is 1 and n, z, and m are all 0, then X is absent. The subsequent definition has been completed to introduce the values for Y<sub>1</sub> and Y<sub>2</sub>, and in particular, it is now made clear for the case in which X is absent, that Y<sub>1</sub> and Y<sub>2</sub> are independently absent or a carboxylate moiety.

It is believed that claim 1 as amended overcomes any indefiniteness and also serves to fully define the invention.

Claim Rejections – 35 U.S.C. 103

Claims 1, 6, 7, 9, 16, 18, 20 to 23, and 25 are rejected under 35 U.S.C. 103 as being unpatentable over Sharifian et al, U. S. Patent 4,904,357, in view of Davidson et al.

Sharifian et al discloses a process for preparing quaternary ammonium or phosphonium borohydrides in an electrolysis cell. The entire teachings of Sharifian et al are drawn to the procedure and process parameters for producing these borohydrides electrolytically. There are then very brief statements, indeed a matter of lines, in the text of Sharifian et al indicating areas of use of these borohydrides. The sum total of the teachings with respect to bleaching of paper pulp is contained in a single short sentence at column 5, lines 41 to 44, which reads:

"For example, the solution can be used in the reductive bleaching of paper pulp and for reducing various organic compounds."

This is all that is stated with respect to bleaching of paper or pulp.

Of course, how the bleaching is accomplished is not specifically explained in Sharifian et al by the borohydride anion. It is well known from the literature that sodium borohydride is a reductive bleaching chemical for wood pulps [Mayer, W. C. and Donofrio, C. P., "Reductive Bleaching of Mechanical Pulp with Sodium Borohydride", *Pulp Paper Mag. Can.*, 10: 157-163, 166 (1958)]. The ammonium or quaternary phosphonium ions, [(R<sub>1</sub>R<sub>2</sub>R<sub>3</sub>R<sub>4</sub>)N]<sup>+</sup> or [(R<sub>1</sub>R<sub>2</sub>R<sub>3</sub>R<sub>4</sub>)P]<sup>+</sup> of Sharifian et al are merely the counter cations for the reductive borohydride anion. In the quaternary phosphonium salt compounds, [(R<sub>1</sub>R<sub>2</sub>R<sub>3</sub>R<sub>4</sub>)P]<sup>+</sup><sub>a</sub>X<sup>-a</sup>, used to make the corresponding quaternary phosphonium borohydrides, [(R<sub>1</sub>R<sub>2</sub>R<sub>3</sub>R<sub>4</sub>)P]<sup>+</sup>BH<sub>4</sub><sup>-1</sup>, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> and R<sub>4</sub> are each independently alkyl groups containing from 1 to about 10 carbon atoms, hydroxyalkyl or alkoxyalkyl groups containing from about 2 to about 10 carbon atoms. Sharifian et al's quaternary phosphonium salts or phosphonium

borohydrides are then different from the phosphonium compounds claimed in the present invention, where at least one of the groups attached to the quaternary phosphonium ion is a hydroxymethyl, (-CH<sub>2</sub>OH) group (i.e., a hydroxyalkyl group containing one carbon atom). The requirement for the presence of such a hydroxymethyl group is demonstrated in Example 3 of the present invention where the bleaching of the pulp is achieved by treatment with THPC, [P(CH<sub>2</sub>OH)]<sub>4</sub>Cl, but not with tetraethylphosphonium chloride (TEPC), [P(CH<sub>2</sub>CH<sub>3</sub>)]<sub>4</sub>Cl. TEPC is a quaternary phosphonium compound containing no phosphorus hydroxymethyl bond/linkage (P-CH<sub>2</sub>OH) and furthermore is a phosphonium compound used to make one of the phosphonium borohydrides in U. S. Patent 4,904,357 (Sharifian et al). In addition, the phosphonium compounds disclosed in the present invention do not require borohydride (BH<sub>4</sub><sup>-1</sup>) as the counter anion. It should also be noted that borohydride, BH<sub>4</sub><sup>-1</sup>, is a Lewis base, not a Lewis acid as has mistakenly been indicated in the Office Action.

There is no teaching or suggestion in Sharifian et al of the phosphonium compounds of the present invention and still less that they would have a bleaching and brightness stabilization effect. It will be noted that borohydride is not among the list of anions contemplated by claim 8 in the present application.

In the bleaching and brightness stabilizing of the present invention, it is the "phosphorus" component bearing a hydroxymethyl group which is responsible for the bleaching and brightness stabilization, not the counter anion X when present. Sharifian et al is concerned only with the electrolytic production of a different class of ammonium or phosphonium compounds (not having a hydroxymethyl group), and for which there is only a very brief comment as to utility of the resulting borohydrides, and it is evident that it is the borohydride that is of value in Sharifian et al for the different areas of utility indicated. Indeed, if it were the phosphonium portion of the molecule that was required for the different utilities such as bleaching of pulp, by Sharifian et al, there will be no reason to produce the borohydrides and indeed the starting materials for Sharifian et al include phosphonium salts such as tetraethylphosphonium chloride (TEPC).

Davidson et al represents a study of photoyellowing of paper when such papers are irradiated in aqueous solutions containing different reducing agents. The teaching at page 421 with reference to Table 1 is that certain reagents bleach the paper and that other reagents retarded photoyellowing. THPC was among the agents that are indicated as retarding the photoyellowing but not bleaching the paper.

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In any event, the only phosphonium compound described by Davidson et al is not within the class of phosphonium compounds of Sharifian et al.

Davidson et al does not teach that the specific phosphonium compound bleaches pulp. On the contrary, it teaches that it does not bleach pulp (i.e., it is not in the list of reagents at page 421 which was said to bleach the paper; rather, it is in the list that was said to retard photoyellowing).

Concerning the first complete paragraph at page 6, Davidson et al identifies only one phosphonium compound, and it is not one of the phosphonium compounds of Sharifian et al and, therefore, it is not seen how any conclusions could be drawn as suggested, especially in that Sharifian et al contains no "informative" teaching whatsoever with respect to bleaching of paper. Sharifian et al teaches how to make particular ammonium and phosphonium borohydrides electrolytically. These compounds of Sharifian et al do not include the phosphonium compounds of the present invention bearing a hydroxymethyl group.

Concerning the second complete paragraph at page 6 of the Office Action, the reducing species in Sharifian et al is the borohydride anion. Davidson et al contains no teachings whatsoever with respect to borohydrides.

The dependent claims 6 and 7 are distinct from Sharifian et al and any combination with Davidson et al for the same reasons indicated above with respect to claim 1.

Claim 9 is still further removed from Sharifian et al since it requires plural hydroxymethyl groups.

Concerning claims 16, 18, and 20 and the teaching of Sharifian et al, the sum total of the teaching of Sharifian et al with respect to paper is indicated above and is essentially no teaching at all. The teaching of Sharifian et al is to an electrolytic procedure for producing particular classes of borohydride. Persons in the art would know that borohydrides may be used in the reductive bleaching of paper. This is all that can be inferred from Sharifian et al. Davidson et al does not overcome the limitations of Sharifian et al.

Concerning claims 21 to 23 and 25, Sharifian et al not only does not disclose expressly the conditions under which or vessel in which bleaching occurs, it discloses nothing at all of the bleaching even in a general way other than the broad statement that the borohydride solution can be used in reductive bleaching of paper pulp.

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In any event, even if the conditions described by Davidson et al are applied to the materials of Sharifian et al, this does not result in the present invention which employs distinctly different phosphonium compounds neither taught nor suggested by Sharifian et al.

With respect to the solubility, Sharifian et al's compounds are not within formula (A).

Claims 21 and 22 serve to set forth useful operating parameters for the method of the invention, as do claims 23 and 25. A further advantage of the compounds (A) of the invention is that they can be employed over a broad range of process parameters.

Concerning claim 8, Bowdery et al has been considered previously. The phosphonium salts in Bowdery et al are employed to kill bacteria and destroy enzymes in hydrogen peroxide which contains such bacteria and enzymes, which hydrogen peroxide is intended for bleaching of pulps. The teachings of Bowdery et al are completely unrelated to those of Sharifian et al and Davidson et al, and any equivalency in Bowdery et al has no relevance to the different purposes in the present invention. Furthermore, the phosphonium cation of Bowdery et al is outside the scope of the phosphonium cation of Sharifian et al, and Sharifian et al is concerned **solely** with borohydrides and not with sulphates or chlorides.

The bleaching referred to by Sharifian et al relies on the borohydride anion, and teachings relating to sulphates are of no relevance to Sharifian et al.

The same comments apply with respect to claim 14.

Concerning claims 17, 19, 24, and 34, the addition of Liebergott et al does not overcome the basic deficiencies of Sharifian et al in view of Davidson et al since Sharifian et al is concerned with a different class of phosphonium compounds.

As indicated previously, Liebergott et al merely discloses what are conventional bleaching operations as acknowledged in the present specification as well as the nature of the lignocellulosic materials.

Reconsideration is requested.

Allowable Subject Matter

Claim 15 is indicated as defining allowable subject matter. The objection to claim 15 under 35 U.S.C. 112 has been met by editorial amendment, for clarity, in claim 1.

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The application is believed to be in condition for allowance, and early and favourable action would be appreciated.

Respectfully,

THOMAS Q. HU ET AL

By:

A handwritten signature in black ink, appearing to read 'K. Murphy', is written over the printed name of the agent.

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